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The role of hydrodynamic forces in the confinement and assembly of magnetic dipoles M. PRIKOCKIS, A. CHEN, R. SOORYAKUMAR, Ohio State Univ - Columbus — The confinement of interacting magnetic dipoles provides a means to probe the assembly of and many-body coupling within a mesoscopic system. Using a previously developed confinement method (Scientific Reports 3, 3124 (2013)), we investigate the role of hydrodynamic forces in one such mesoscopic system that supports a fluid borne suspension of microscopic beads that contain embedded superparmagnetic particles. Our confinement platform consists of a thin permalloy disk patterned on a silicon surface and a precessing magnetic field. By adjusting the orientation of the field, inter-particle dipolar and trap confinement forces are tuned - thereby enabling the plane-confined beads to repel or attract one another. At a specific field orientation, the dipolar interaction is weakened to provide a regime where the hydrodynamic forces, stemming from rotational motion of the beads, play a role in bead assembly. We investigate the dependence of dipole ordering on the hydrodynamic forces by varying the frequency of the field rotation in this special field configuration. This represents a unique system where the hydrodynamic forces of fluid borne magnets are tuned independently of the magnetic forces in a magnetic dipolar confinement scheme.

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